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Prospective Evaluation of Occlusive Hydrocolloid Dressing Versus Conventional Gauze Dressing Regarding the Healing Effect After Abdominal Operations: Randomized Controlled Trial

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OBJECTIVE: To compare occlusive hydrocolloid dressing (OHD; Karayahesive) and gauze dressing (GD) with regard to the cost and incidence of wound infection after abdominal surgery.
METHODS: A total of 134 patients who underwent incisions were randomized to have their wounds dressed with either OHD or GD. OHD was left on until the sutures were removed, and GD was changed everyday postoperatively. The cost calculations represent the number of dressings required for each treatment group as determined by the frequency of required dressing changes and cost per dressing.
RESULTS: There were no differences between the groups regarding the need for dressings to be changed or the incidence of infection. OHD was less expensive and complicated than GD, which needed to be changed everyday ($p < 0.0001$).
CONCLUSION: The results suggest that OHD is less expensive to use than GD, and the risk of wound infection is not increased compared to GD. [*Asian J Surg* 2008;31(1):1–5]

Key Words: gauze dressing, incisional wounds, occlusive hydrocolloid dressing

Introduction

A moist environment under occlusive wound dressings appears to accelerate healing. Since Winter's classic study in 1962,[1] which showed increased wound epithelialization at a moist donor site under an occlusive bandage, numerous studies have reported the beneficial effects of moist wound healing. Concerns that moisture in wounds may increase the risk of infection have been raised, but most cases have proven this fear to be unfounded.[2–4]

Recently, occlusive hydrocolloid dressing (OHD) in the wound healing process has been reported to be more effective than usual gauze dressing (GD). A moist wound environment plays an important role in facilitating the recruitment of both vital host defences and the necessary cell population that helps to promote the healing process.[5,6] Different growth factors have been isolated in the wound fluid beneath OHD, and they stimulate both cell proliferation and differentiation.[7,8] The relatively hypoxic wound environment under an OHD accelerates angiogenesis and promotes wound repair processes.[9,10] OHD may therefore be good absorbents and thermal insulators, and they are also a good barrier to contamination, particularly when moistened by wound secretion or blood.

Surgical site infection (SSI) and wound and tissue dehiscence are well-known postoperative complications

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after gastrointestinal surgery. SSIs prolong hospitalization, with a substantial increase in the cost of care. Traditionally, local factors such as the degree of contamination and surgical technique have been regarded as strong predictors for SSI and wound dehiscence.[11,12] Abdominal incisions are typically covered with conventional GD or OHD since it is commonly believed that dressings do influence the healing process. Patient personal hygiene is not facilitated when GD is used, and frequent changes are both time-consuming and sometimes painful. With OHD, frequent dressing changes can be avoided, which reduces the time and costs associated with dressing changes. At present, there are few papers on randomized trials of OHD versus conventional GD.[13–16]

The purpose of this prospective randomized study was to compare the cost and incidence of wound infection between OHD and GD.

Patients and methods

From November 2003 to March 2006, a cohort of 134 consecutive patients operated on for gastrointestinal disease was evaluated. The operations were all performed at the Department of Gastrointestinal Surgery, Fukuoka University Hospital, and included gastric, duodenal, pancreatic, and biliary surgery, as well as operations on the colon and rectum. Anal and perianal operations, and peritonitis and emergency operations were excluded. We used cephamycin antibiotics postoperatively for 3 days.

OHD (Karayahesive; Alcare, Tokyo, Japan) is a dressing that consists of an outer permeable polyurethane membrane with a thin absorbent and adhesive hydrocolloid interface. The hydrocolloid layer creates a moist environment between the polyurethane membrane and the wound surface. Dressings were evaluated postoperatively by daily wound inspection until the patient was discharged. Exudate, leakage, adhesion of the dressing to the skin, and transparency were recorded. Dressings were changed only if the dressing leaked or slipped. Dressings were discontinued if a clinical wound infection developed (as diagnosed by pus, pyrexia and local tenderness). GD was removed on postoperative day 7 (according to the department's routine), while OHD was left in place until the sutures were removed 7 days after operation. Cosmetic outcome was assessed at the final follow-up 3 months after operation.

A prospective randomized study was designed to compare the incidence of infection for abdominal wounds, along with the cost for each dressing type. Postoperative tissue and wound complications were defined as SSIs (superficial or deep wound infection, wound abscess). The definition was based on the CDC's *Guidelines for Prevention of Surgical Site Infection (1999)*.

The cost calculations represent the number of dressings required for each treatment group as determined by the frequency of required dressing changes and the cost per dressing. In addition, the cost of materials used (OHD, GD, povidone-iodine for disinfection, and cotton balls) during the wound control period was calculated for the OHD and GD groups. We determined the time needed to change a dressing to be 5 minutes.

This randomized controlled trial was approved by the ethics committee on clinical investigation of Fukuoka University Hospital. For patients who met the inclusion criteria, informed consent was obtained from the patient before randomization. Before entering the trial, we explained the criteria of this study to all patients. Randomization was stratified equally across the operating theatre and it was achieved using opaque envelopes.

Statistical analysis

For comparison of the frequencies, categorical data were analysed using Fisher's exact probability test and Student's *t* test using SPSS software (SPSS Inc., Chicago, IL, USA). The minimum sample size that was necessary for this study was 52 patients in each group (α error set at 0.1, $\pi 1 = 0.15$, $\pi 2 = 0.03$, power = 80%). A p value of less than 0.05 was considered to be significant.

Results

Of the 134 patients included in this study, 63 were randomized into the OHD group and 71 into the GD group. No patients were excluded in this study. There were 79 males and 55 females; mean age was 63.5 years (range, 31–91 years). The age and sex distribution did not differ between the two groups. The diseases included 122 cases of malignant diseases and 12 cases of benign diseases (Table 1). The mean length of the wounds was 15.6 ± 5.9 cm in both groups.

The OHD stayed in place for a mean of 8.3 ± 0.6 days (Table 2). The OHD was totally transparent during the entire postoperative period in all 63 (100%) OHD cases; in no case did it become so opaque that the wound and sutures could not be seen through the dressing (Figure).

Table 1. Characteristics of the occlusive hydrocolloid dressing (OHD) and gauze dressing (GD) groups

	OHD ($n=63$)	GD ($n=71$)	Total ($n=134$)
Male, *n* (%)	37 (59)	42 (59)	79 (59)
Female, *n* (%)	26 (41)	29 (41)	55 (41)
Mean age, yr (range)	64.1 (31–80)	63.0 (34–91)	63.5 (31–91)
Diagnosis			
Malignant			122
Gastric carcinoma	24	25	49
Colorectal carcinoma	24	29	53
Liver carcinoma (hepatocellular and metastatic)	8	7	15
Gallbladder and cholangiocarcinoma	2	1	3
Pancreatic carcinoma	0	1	1
Malignant lymphoma (spleen)	1	0	1
Benign			12
Cholelithiasis	2	4	6
Splenomegaly	0	2	2
Incisional hernia	2	2	4

Table 2. Results for the occlusive hydrocolloid dressing (OHD) and gauze dressing (GD) groups*

	OHD ($n=63$)	GD ($n=71$)	Total ($n=134$)	$p^{\dagger}$
Wound				
Length, cm	14.6 ± 6.2	16.4 ± 5.5	15.6 ± 5.9	0.074
Operation time, min	217.7 ± 104.7	248.2 ± 98.9	233.5 ± 101.8	0.0810
Time dressing stayed on, d	8.3 ± 0.6	8.4 ± 1.3	8.3 ± 1.1	0.2937
Scar width,[‡] mm	2.2 ± 2.4	2.3 ± 2.4	2.3 ± 2.4	0.9356
Number of dressing changes	2.1 ± 0.8	11.8 ± 6.0	7.0 ± 6.4	< 0.0001
Time taken to change dressing, min	10.6 ± 4.5	57.4 ± 30.1	35.0 ± 32.1	< 0.0001
Cost of dressing per patient,[§] ¥	714.9 ± 262.8	779.9 ± 345.3	749.0 ± 309.1	0.2227

*Data presented as mean ± standard deviation; [†]Student's *t* test; [‡]scar width was measured on postoperative day 60; [§]dressing cost = OHD or GD + povidone-iodine + cotton balls.

Postoperative wound infection occurred in two patients, one in the OHD group and one in the GD group ($p=0.567$; Table 3). There were three patients with noninfection-related wound exudate. There were no differences between the two groups regarding the need for dressings to be changed. The mean follow-up time was 90 days in both the OHD and GD groups. The mean scar widths directly measured were 2.2 mm in the OHD group and 2.3 mm in the GD group (Table 2).

OHD had to be changed much less frequently than GD. However, OHD was not more expensive than GD, which had to be changed everyday (Table 2).

Discussion

Routine dressings of sutured surgical wounds are based on tradition and, to our knowledge, the use of such dressings is not supported scientifically. In this study, we evaluated the performance of a transparent OHD on abdominal incisional wounds during the early postoperative period. We found that the OHD adheres securely to the skin until the sutures are removed, without loosening or slipping at the edges in almost all cases. The small amount of exudate that escapes from the wound is easily contained under the dressing, and leakage and exudate are not a

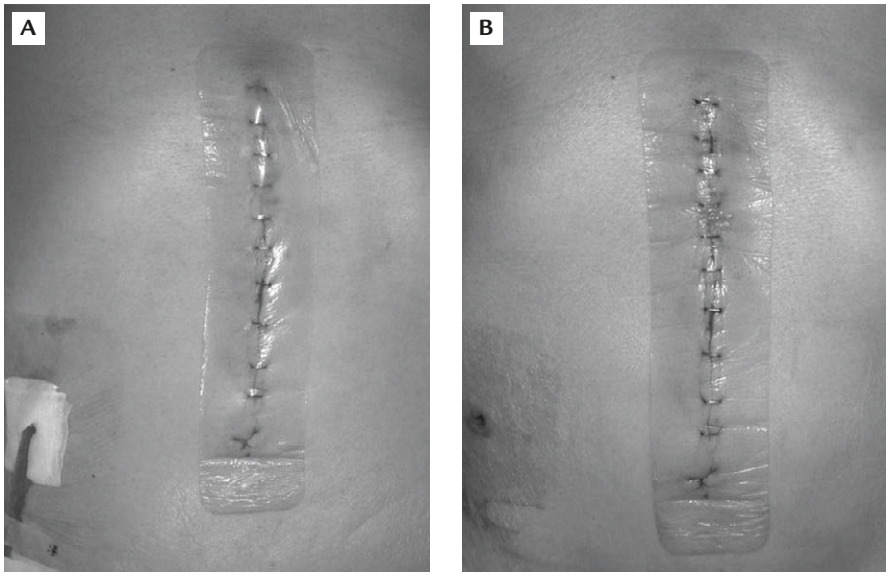

Figure. (A) Immediately after operation. (B) Postoperative day 7. The occlusive hydrocolloid dressing adhered securely to the skin and remained transparent until the sutures were removed.

Table 3. Wound infection in the occlusive hydrocolloid dressing (OHD) and gauze dressing (GD) groups

	OHD ($n=3$)	GD ($n=4$)	Total
Bacteria	*Bacteroides fragilis*	*Bacteroides fragilis* *Enterococcus faecalis*	
Operation	Low anterior resection Hemicolectomy Distal gastrectomy	Low anterior resection Hemicolectomy Sigmoidectomy	
Surgical site infection, % (n)	4.8 (3/63)	5.6 (4/71)	5.2 (7/134)

Fisher's exact probability test, $p=0.567$.

problem, as reported previously.[2,17,18] The dressings remain transparent until the sutures are removed, thus allowing for good control of the wound area and sutures during the entire postoperative period. In this study, only a slight opacity was noted, and in no case did such opacity hinder inspection of the wound area. Patients reported discomfort with dressing removal when treated with a dry GD, and this dressing type was also expensive. However, OHD was not more expensive than GD which had to be changed everyday.

Karaya gum has a bacterial growth-inhibiting activity against both *Pseudomonas aeruginosa* and *Escherichia coli*.[19] Our findings confirm the data that have been reported by others: that the rate of wound infection does not increase when OHD is used on surgical incisions. In other words, the SSI rate of OHD was not inferior to GD which is changed everyday. The reported low infection rates in open wounds dressed with OHD also seem applicable to surgical wounds. In this study, the SSI rate was 5.2%. We could thus keep a low SSI rate. We used wound edge protector for all abdominal operation cases. Sookhai et al reported that the use of an impervious wound edge protector resulted in an 84% reduction in postoperative wound infection rates in the contaminated group compared to patients in whom wound protector was not used.[20] In addition, our close observation for SSI was considered to be the key to keeping a low SSI rate.

We were not able to confirm the findings of previous reports which suggested that moist wound healing may reduce scarring and inflammation.[17,18] Lynsky et al attributed the finer scar in wounds covered with an occlusive dressing to a reduced inflammatory response and less clinical inflammation.[17] Although some differences were seen in our data, the width of wound scars using OHD was

small at 3 months postoperatively. Further studies are needed to clarify the effect of occlusive dressings on scarring.

Since the primary end point of this study was the cost of postoperative dressing, the sample size for evaluating the frequency of wound infection (the secondary end point) may have been too small to make any conclusion on the effect of OHD on wound infection. Collection of more cases would be needed. Finally, the findings of this study suggest that conventional GD may not be the dressing of choice for surgical wounds, including abdominal wounds following abdominal surgery.

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